

# Exposure to Noise and Cardiovascular Disease in a Nationwide US Prospective Cohort Study of Women



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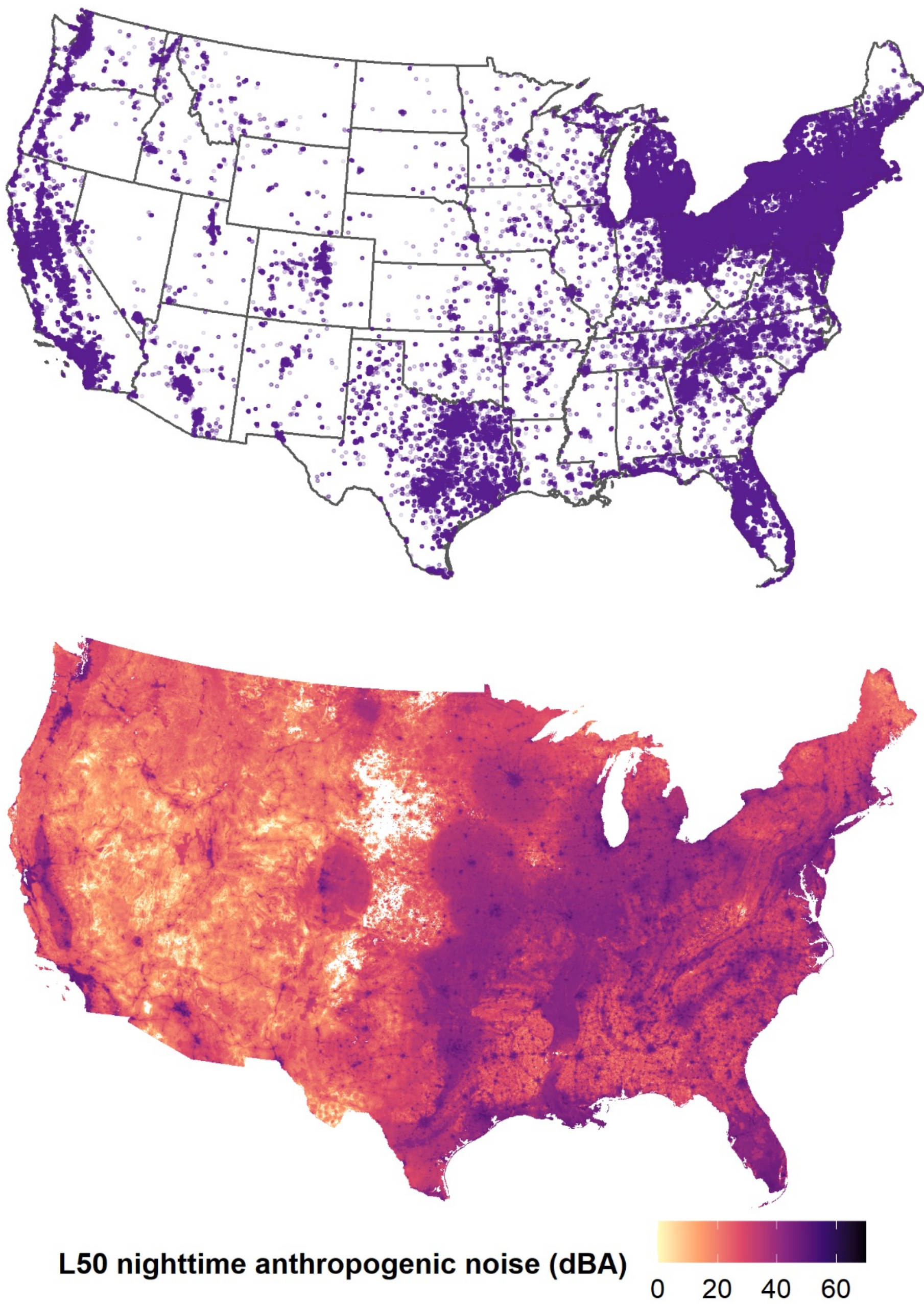
Mass General Brigham

## Background

- Long-term noise exposure has been shown to be associated with cardiovascular disease (CVD).
- Longitudinal cohort studies of noise are mainly European.
- We aimed to examine the prospective association of outdoor long-term nighttime and daytime noise from anthropogenic sources with incident CVD using a US-based, nationwide cohort of women.

## Methods

- Nurses' Health Study (NHS) is a prospective cohort of 121,701 female nurses aged 30-55 at baseline (1976), who have been followed with biennial mailed questionnaires.
- Incident CVD was defined as first occurrence of either non-fatal myocardial infarction/fatal coronary heart disease (CHD) or non-fatal/fatal stroke (stroke). Self-reports were validated with medical record review or searches of the National Death Index.
- We used outdoor noise predictions from the National Park Service geospatial model (270 m x 270 m resolution; 2000-2014) for the contiguous US (Figure 1) and carried backwards/forwards to maximize follow-up (1988-2018).
- Median ( $L_{50}$ ) nighttime (7pm-7am) and daytime (7am-7pm) noise was assessed at NHS residential addresses from 1988 to 2018, incorporating address changes.



**Figure 1. NHS participant addresses throughout follow-up (upper) and long-term average median night noise (dBA) distribution (lower).**

- We used time-varying Cox proportional hazards models to estimate risk of incident CVD, CHD, and stroke 1988-2018 associated with long-term average noise exposure.
- We assessed effect modification by race, population density, region, air pollution ( $PM_{2.5}$ ), vegetation (30 m res. Landsat NDVI), and neighborhood socioeconomic status.
- We explored mediation by self-reported sleep duration.

## Findings

**Table 1. Participants in analysis (n = 112,483).**

Characteristic	N/Mean (SD)/%
CVD	11,100*
CHD	5,854
Stroke	5,246
Age (years)	67.1 (10.3)
White (%)	94
Urban residence ( $\geq 1000$ people/mile <sup>2</sup> ) (%)	9
Northeast (%)	46
Midwest (%)	16
South (%)	17
West (%)	13
12-month average $PM_{2.5}$ ( $\mu g/m^3$ )	12.7 (4.6)
NDVI in 270m residential buffer	0.4 (0.2)

\*over 2,528,558 person-years of follow-up

**Table 2. Adjusted\* Hazard Ratios (95% confidence intervals) per IQR increase in  $L_{50}$  nighttime (3.7 dBA) and  $L_{50}$  daytime (4.6 dBA) noise and CVD incidence.**

Outcome	$L_{50}$ nighttime noise	$L_{50}$ daytime noise
CVD	1.02 (1.00, 1.04)	1.01 (0.99, 1.04)
CHD	1.02 (1.00, 1.05)	1.02 (1.00, 1.05)
Stroke	1.01 (0.98, 1.04)	1.00 (0.97, 1.03)

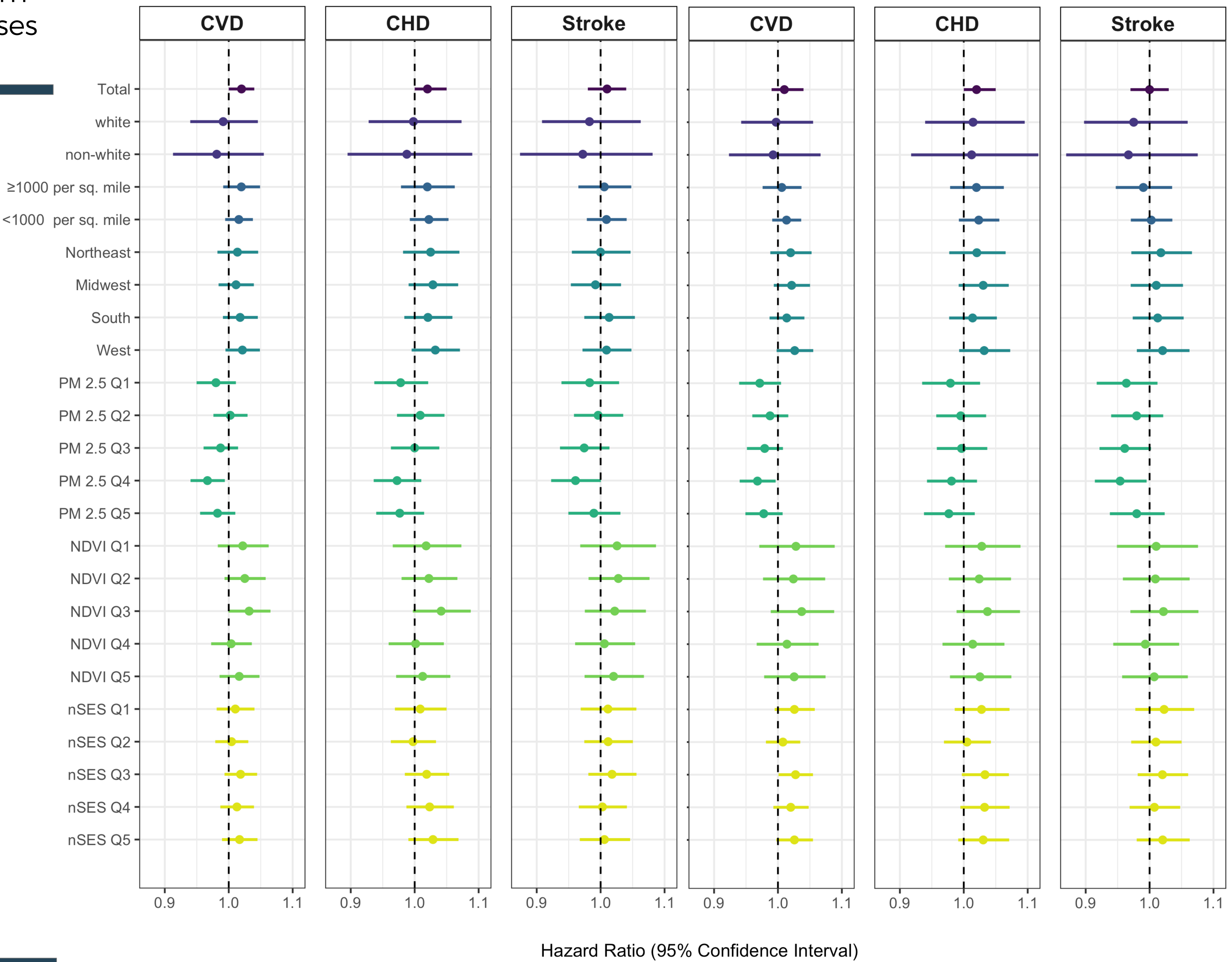
\*adjusted for age (months) and calendar year, race, smoking status, pack-years smoked, family history of MI, menopausal status, postmenopausal hormone use, diet, alcohol consumption, BMI, physical activity, night shift work, parental occupation, educational attainment (RN degree), marital status, husband's highest education, neighborhood socioeconomic status score quintile, region, and annual average air pollution ( $PM_{2.5}$ )

- $L_{50}$  nighttime and daytime noise were associated with very small increased risks of CVD and CHD, but not stroke.

## Total and stratified associations of CVD with

### nighttime noise

### & daytime noise



- In stratified analyses, associations between nighttime noise and CHD were slightly stronger in lower SES neighborhoods.
- There was no evidence of mediation by sleep duration.

## Conclusion

- Outdoor nighttime and daytime noise at residential address was associated with a small increase in CVD risk in a US adult female cohort.